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GENTES HERBARUM

Occasional Papers on the Kinds of Plants

By L. H. Bailey

3. Washingtonia

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28. Group of Washingtonia filifera growing in Los Angeles in 1884, as drawn at that time by J. Harrison Wright.

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ARTICLE 3. WASHINGTONIA.

Aside from coconut and date, the Washingtonias are amongst the most widely planted of palms. This is the more remarkable inasmuch as these palms have been generally known to horticulturists and botanists only fifty to sixty years.

The Washingtonias are native in the western part of the North American continent, in southern California, western Arizona, and northwestern Mexico. They are large fan palms, making tall and often very slender trunks. The boles in nature are covered with a dense shag of old dead leaves that hang prone by their petioles for many years. The shag or petticoat is particularly shapely and durable in the native California species and constitutes much of the beauty of the tree (Fig. 29). In cultivation, however, the shag is frequently removed, the leaf-blades being cut away; the long jagged stubs (petioles) remain and present a most unattractive spectacle. Excuse for such trimming lies in the fact that the shag or petticoat becomes unkempt, and it constitutes a fire hazard, all of which is another way of saying that Washingtonia is not adapted to many of the places in which it is commonly planted.

It is much to be desired that new plantings shall be made in areas where danger from fire and cattle and marauding boys is not a frequent risk, and where the trees may be allowed to take their natural course, often in large enough colonies to bring out their singular beauty. Even in the wild one may not often see perfect trees because of burning, browsing of cattle, and the cutting of leaves for thatch and other uses. This is all the more reason why plantations should be made in places well adapted to these noble trees and also why every care should be exercised to preserve attractive original stands.

In many places, of course, both in the wild and in cultivation, pleasing single trees are seen, when trunks have been kept clean and a comely shag remains under the crown and high enough above ground to escape injury (Fig. 30). Too often, however, the shag is haggled off at the bottom and presents a forbidding unnatural aspect. Washingtonias are formal trees, and every effort should be taken to keep them neat and shapely. The difficulty is greater in the Mexican species for the shag is naturally less presentable and durable, and on the other hand the California species is less adaptable to areas near the coast.

A frequent difficulty in cultivation is heart-rot, whereby the top droops and dies. This is specially harmful in *W. filifera* when planted too near the ocean and the crown remains filled with moisture. In such cases, a proper

treatment should be applied, on direction of a person who has had experience.

The present paper, however, is not intended as horticultural advice but as a systematic monograph for the identification of the kinds. Even though the genus Washingtonia is known to be small, there is nevertheless singular confusion in understanding the species. This situation is due to the variability of the plants in cultivation, often to change in character from youth to age, and to the fact that, outside California, they have not been known or recognized by accurate specific names in a native state. It is often difficult to understand the characters of plants as they occur in the wild by observations only on cultivated subjects. Because of the confusions in identification I have not thought it safe to cite localities and ranges from the literature: this subject can be worked out only after we know the species.

In preparation for this study of Washingtonia I call attention to one of the commonest yet one of the strangest attitudes in the observation of palms by fanciers of them,—the habit of picking out dissimilarities between individual trees as if the differences were marks of species. This practice appears to be general among palm lovers and perhaps even among students of these plants if they happen to have opportunity to see the trees growing. If two trees differ a little in hang of leaf, in minor items in the flower-stalks, in tints of green in the foliage, in direction of the segments, and particularly in size of fruits, the trees must perforce be different species! This fallacy is difficult to overcome or to explain. Persons who would never think of applying such tests to oak trees or oranges, to pine trees or tomatoes, may nevertheless maintain them with the utmost conviction in all kinds of palms, so much so that it is almost impossible to convince them that palms are as variable as are many other kinds of plants or to instruct them in real specific differences. I introduce the subject here because I fear this prevailing error will prevent an understanding of the plant I consider to be true *Washingtonia robusta*.

HISTORY OF WASHINGTONIA

These palms began to be noted in horticultural literature from 1874 to 1877, and in 1879 Hermann Wendland, at that time the recognized authority on palms, published a botanical account and established the generic name Washingtonia. All these early publications known to me are in French, Italian and German periodical literature, although these palms had been noted in the wild by travelers before that time and had been introduced to cultivation in Mexico and California. Ed. André inserted a brief note in L'Illustration Horticole in 1874 in his discussion of *Pritchardia pacifica;* to him the new palm was known as *Pritchardia filifera* and he credits the introduction of it to Linden, a noted horticulturist and nursery-

29. PERFECT TREES of *Washingtonia filifera*, on a thoroughfare in Riverside, California. Natural growth, without trimming.

man of Ghent, Belgium. Drude mentions it in a discussion in Botanische Zeitung, December 1876, of American palms introduced into the Old World, calling it *Pritchardia filamentosa*. In his botanical account in Botanische Zeitung in 1879, Wendland states that the first introduction was due to the activity of Linden; "if I am not mistaken, it was introduced by him as early as 1869 and was first shown by him at the spring exposition in Ghent in 1873. Since that time, there have been sent over of this species great quantities of seeds and also living plants so that it is now found in almost every bigger garden." The Wendland date, however, is questioned by Parish in his discussion in Botanical Gazette for December 1907; he quotes a letter from the younger Linden stating that his father received a dozen seeds from California about 1872.

In Linden's Catalogue no. 92 for 1874-5, "New or Rare Palms," this plant is not mentioned; in no. 93 for 1875 there is one line of entry of *Pritchardia filifera*. In Catalogue no. 96, 1876, English edition, is the following entry:

PRITCHARDIA FILIFERA

(Brahea filamentosa)

"This Palm is one of the most beautiful of the handsome family to which it belongs. All who saw it at the International Exhibitions of Vienna, Florence, Ghent, Louvaine, etc., will remember its remarkably fine appearance and the admiration which it excited. It grows farther north than any other of the Palm tribe, its native habitat being the banks of the Colorado, in the province of Arizona, in New Mexico, where it bears the winter frosts without injury. It is excessively graceful in appearance, long white filaments falling from its palmate leaves, giving them the appearance of being furnished with plumes. This variety ought to occupy a conspicuous position, not only in private collections but also in those of public gardens. It will be found to form a good substitute for Latanias, Phoenixes, and similar palms, of which amateurs are rapidly beginning to get tired. In the south of Europe it is perfectly hardy, but in more northerly climates it will succeed best under the protection of an ordinary conservatory or greenhouse."

The Catalogue contains a woodcut of the palm, but it is not characteristic of a young plant of the California Washingtonia, although undoubtedly intended for that species. This picture reappears in L'Illustration Horticole for 1877, page 33.

In Catalogue no. 97, 1877, *Pritchardia filifera* is described again.

In 1876, also, appeared an account in the Italian journal "Bulletino della R. Societa Toscana di Orticultura," with a recognizable picture of the California Washingtonia. The palm was called *Pritchardia filamentosa*. The article is by E. O. Fenzi, the energetic horticulturist who afterward came to North America and as F. Franceschi organized the Southern California Acclimatization Association and as early as 1895 published

30. WELL GROWN TALL TREE of *Washingtonia filifera*, when it is necessary to remove the lower shag or thatch.

"Santa Barbara Exotic Flora"; he lived in California in the years 1892 to 1913; he closed his useful career in plant acclimatization work in Tripolitania; he died at Tripoli in November, 1924.

The native fan palm, and probably the Mexican species, must have been widely planted in California long before they were introduced into Europe. Thus a note in Gardeners' Chronicle, London, in July 1876, written by H. Williams, an English nurseryman, describes two trees near San Francisco and states that many large specimens were growing in the state:

"Brahea filamentosa in California.—When visiting the grounds of Mr. Lathans, Menlo Park, San Francisco, I had the pleasure of inspecting two splendid specimens of this fine Palm: they were growing on the lawn in front of the main entrance to the house, and the effect produced was both majestic and charming. The height of the stems of these plants both measured 25 feet clear, and the heads about 15 feet in diameter, the petioles are from 5 to 6 feet long, and I should think at least from 4 to 6 inches wide at the base. The leaves of this species are covered with masses of white filaments, which in these examples hang far below the leaves; I measured some, and found them to be from 2 to 3 feet long. This Palm is quite hardy [Native in S. California. EDS.] in California, and, judging from the position this pair was in—within a few miles of the Pacific Ocean, where I am told the wind blows incessantly all through the summer months —it should prove a most desirable object for subtropical work at home. It is the strongest growing Palm I have ever seen, and withstands the elements better than any other Palm in cultivation here. I am surprised to find this species has not been introduced to Europe before, as there are many specimens to be found in California, of large dimensions, and in every instance it has proved itself far superior to any other Palm for subtropical work."

As early as 1884 large trees of *W. filifera* grew in Los Angeles, as witness the beautiful drawing (Fig. 28) made in that year by J. Harrison Wright, now proprietor of the well-known and attractive palm garden in Riverside. At that time Los Angeles was a straggling town with orchards about it, and in the subsequent years all the old landmarks have been swept away so that the exact location of the picture cannot be stated. The clump stood near Third Street somewhere between Alameda and San Pedro Streets. The picture is proof enough that the palm was early introduced to cultivation. These trees were probably thirty-five years old at that time.

In one of its native places the California palm was noted as early as 1846, although the record of it is little more than casual. This we learn from the late S. B. Parish of San Bernardino who published a valuable account of the Washingtonias in Botanical Gazette for 1907 (page 408), and several references occur in travel accounts previous to the botanical examination of the case by Wendland

The discovery of 1846, according to Parish, was made by "the party of the military reconnoisance under Major W. W. Emory, now nearing the end of their long journey, through unexplored mountains and arid deserts, from the Missouri River to San Diego." No description was left of the palm at that time. The discovery was made when following "the sandy bed of the Carriso," the palms being "projected against the cliffs."

There has been much speculation on the origin of the palm seed introduced into Europe. At the outset of such an inquiry one must remember that European knowledge of the geography of the southwestern part of the United States sixty and more years ago was not likely to have been exact. The statement by Linden that his introduction was from "the banks of the Colorado, in the province of Arizona, in New Mexico" attests this fact. It was not till 1912 that the territories of Arizona and New Mexico were admitted to statehood in the Union. It is probable that the introductions were from trees in cultivation. Parish adds, "there is reason to believe that some of the earliest subsequent importations of seed were collected by the late George W. Dunn in Cantillas Cañon, on the desert borders of northern Lower California."

On the sources of the European introductions we have a subsequent contribution by S. B. Parish in Botanical Gazette in 1909 (page 462). He states positively that the palms on which Wendland founded the genus Washingtonia were grown from seed procured by Roezl, who was a traveling seed collector in the western hemisphere beginning as early as 1868. He it was also who supplied seeds of *Brahea Roezlii* to European gardens, a palm which in the course of time became *Erythea Roezlii*. After making review of all the circumstances of the introduction of Washingtonia to Europe, Parish concludes as follows:

"It appears from this account that the only opportunity which Roezl had of procuring seeds of Washingtonia was during his visit to San Diego, in December 1869. The notes, however, contain no reference to this palm. But a visit to any of its desert habitats would certainly have been an experience too notable to have failed of record. Nor is it probable that his visit to San Diego, so short and so diligently occupied in collecting, could have afforded time for the difficult journey to the desert. The vague and confused habitat assigned to the palm is itself a sufficient evidence that the collector, from whom the information must have come, could never have visited a native grove. It is safe to conclude that the seed he sent to Europe came from some of the older cultivated trees at San Diego, and that his pardonable ignorance of local geography prevented him from correctly understanding what was told him of the location of the indigenous groves."

A fossil palm has recently been found in Los Angeles County, California, photograph of which is before me. It is a petiole and basal part of leaf.

The imprint soon dissolved after it was exposed to the air. It looks like *Washingtonia filifera*. Account in "California Highway and Public Works," January, 1932, makes the following statement:

"Near Bridge Canyon, 6½ miles north of Castaic School, the fossilized imprint of a palm leaf was found embedded in sandstone. The depth at which this fossil was found has been estimated at from 25 to 30 feet below the present ground surface.

"Traces of the tip of the leaf and a portion of the stem had been obliterated, probably by blasting operations preceding the discovery of the imprint. The part found was approximately 3½ feet long and 1½ feet wide across the leaf and closely resembles the leaves of palm trees now growing in the vicinity of Los Angeles."

Director Wm. Alanson Bryan of the Los Angeles Museum writes me that they have a specimen of a palm leaf, presumably fragment of a Washingtonia, collected at the Austin Quarries, Calabasas, California, being a positive cast bedded in limestone, probably of the Miocene period.

The generic name Washingtonia for these palms has not had a clear title. It was proposed, as we have found, by Wendland in 1879 "as a remembrance of the great American" (als Erinnerung an den grossen Amerikaner, von). Long before this time (in 1818) this name had been mentioned in an inadvertent way by Rafinesque for the genus more properly known as Osmorhiza, of the Umbelliferæ. The name had been proposed also in 1854 by Winslow for the trees now known as Sequoia, but under conditions hardly constituting valid botanical publication. To escape these difficulties Sudworth in 1897 proposed the name Neowashingtonia for the palms, but this designation is now generally considered to be unnecessary.

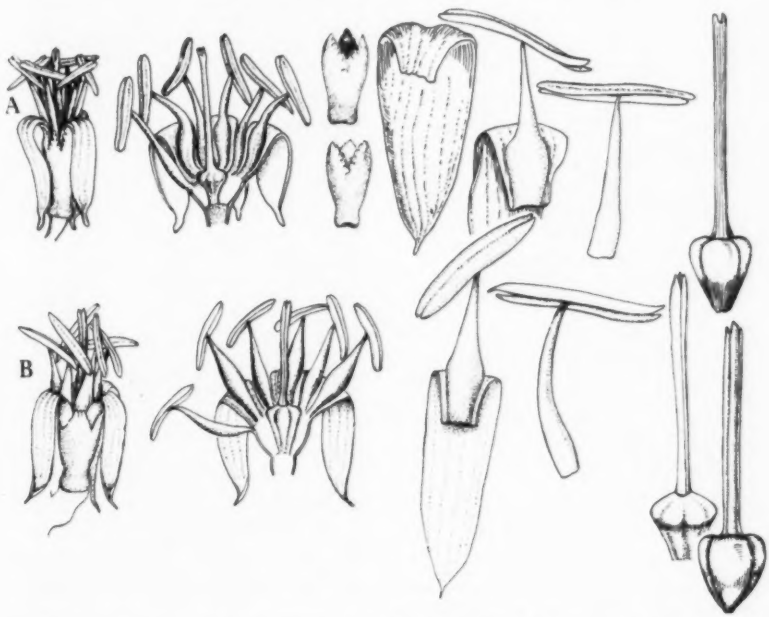
Botanical Account

With these brief statements in historical review we may now pass to a botanical investigation of the palms themselves. We shall find great uncertainty in the effort to comprehend the species, with corresponding perplexity in nomenclature. Five species have been proposed, with the differences between them not clearly defined. It has been necessary, in preparing this monograph, to make rather extensive observation of these palms as they grow, over a series of years. I have studied them carefully in cultivation in many widely separated regions and conditions, and in the wild in California and Arizona, as well as in Mexico including Baja California. I feel that the Washingtonias have now been traced to their sources, and that the species yet known are but two. This conclusion agrees with that of O. F. Cook in 1923 (Standardized Plant Names, 356, 527). This result may not be accepted easily by horticulturists.

It is apparent there is no type locality for the species inasmuch as the botanical names were first applied to plants of unknown nativity in cultivation. It is probable, as Beccari thought, that the very plants Wendland knew, apparently in pots, on which to found his descriptions may now be mature trees in the Mediterranean region, whither they may have been sold, yet one would not care to hazard an opinion based on the supposed discovery of them, nor is such an effort necessary. The diagnoses of Wendland must be accepted as sufficient starting point for both species.

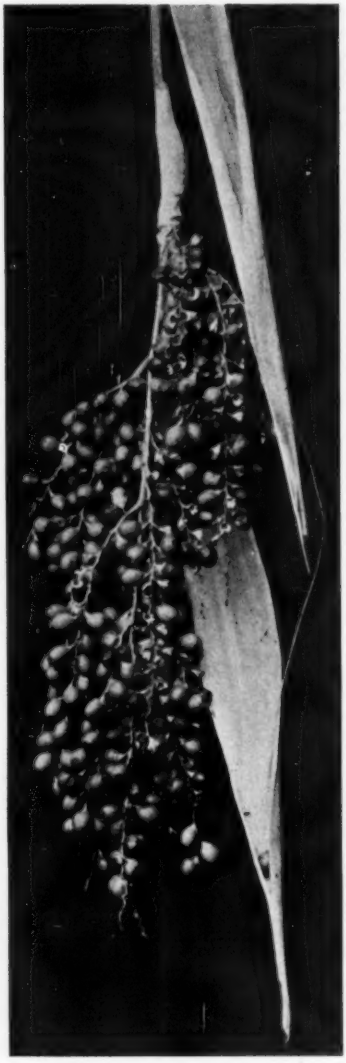
On the subject of the taxonomic origins of these palms Parish writes as follows (1907): "The type source of *W. filifera* is unknown, the native home of *W. gracilis* remains unvisited, the haunts of *W. sonoræ* seldom have been penetrated, but many botanists have stood beneath the groves of the desert *W. robusta*, and it has long been familiar in cultivation in southern California." This statement now needs modification, and we have learned that the first problem is clear definition of species and then the nativities work themselves out naturally.

Three efforts have been made to account for all the species botanically:



31. FRESH FLOWERS of the Washingtonias. A is *W. filifera:* flower as it stands; opened; two calices; reflexed corolla-lobe; stamen attached to lobe; alternate stamen; pistil. B is *W. robusta*: normal bloom; opened; stamen on reflexed lobe; alternate stamen; pistils from two flowers. Differences are unimportant. Much enlarged.

32. RIPE FRUITS of Washingtonias, the styles not yet fallen. *W. robusta* above, *W. filifera* (large-fruited form) beneath. Seeds underneath. (× 2)



33. FRUIT-CLUSTER of *Washingtonia robusta*. (× 2/3)

Odoardo Beccari of Florence, Italy, Webbia, volume 2, pages 182-200 (1907), with recognition of three species and two botanical varieties; S. B. Parish of San Bernardino, California, in Botanical Gazette, volume 44, pages 408-434 (December 1907) with extensive bibliography, recognizing three species and two varieties, *W. gracilis* being new, and a supplementary discussion on structure of flowers in volume 46, pages 144-147 (August 1908); Marcus E. Jones of Claremont, California, in his Contributions to Western Botany no. 15, pages 46-50 (1929), in which apparently only one species is recognized with varieties, and confused with Erythea. A brief enumeration in a posthumous work of Beccari, revised and edited by Martelli, 1931, is contained in Annals of the Royal Botanic Garden, Calcutta, xiii, 307-8; no innovations are made in nomenclature of the Washingtonias.

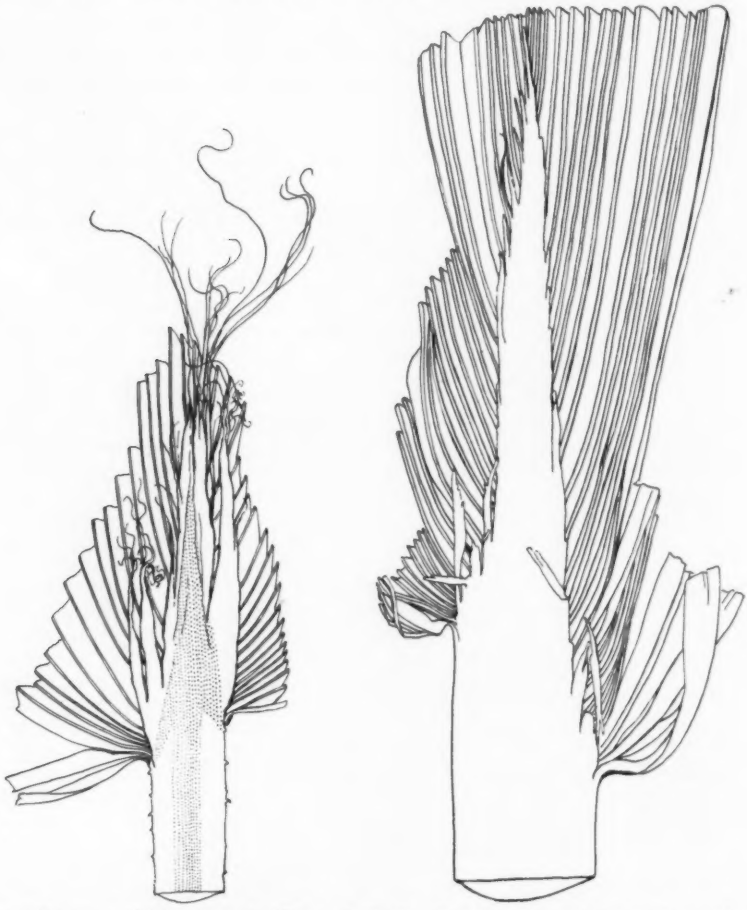
WASHINGTONIA, Wendl. in Bot. Zeit. xxxvii, 68, 148 (1879); Wats. in Bot. Calif. ii, 211 (1880).

Neowashingtonia, Sudw. in Bull. 14, Div. For., U. S. Dept. Agr. 105 (1897) and Bull. 17, 38 (1898).

Tall robust fan palms with single trunk, interfoliar spadices 2-4 m. long that commonly reach beyond the leaves and gracefully overcurve or hang, very numerous small hermaphrodite flowers with tubular calyx, and little oblong hard single-seeded fruits less than 1 cm. long: trunk columnar when bare of the dead leaves that naturally hang for several years and make a complete mantle or shag (which in the wild is likely to be burned away): leaves large and heavy, not truly glaucous, variously filiferous at least until great height of tree is attained, in general glabrous but often tomentose on under surface about hastula and with more or less loose wool on ridges when young, the stout flattish petioles variously spine-bearing along the two margins and projected into the blade with an arrowhead point or hastula that may be strongly winged or margined at first: spadix long, issuing from a flattened 2-edged smooth main spathe 1 m. or so long and 1 dm. broad, and provided with flat free ribbon-like spathelets at the well separated nodes, once or twice or thrice branched with pendent members or thyrses, the rachillæ slender and glabrous: flowers whitish, short-pedicelled, showy by their numbers when in full anthesis, about 8 mm. long including the prominently exserted stamens, calyx tubular and nearly as long as the 3 strongly reflexed narrow corolla-lobes and persistent after corolla falls, stamens 6 attached at base of corolla, each alternate one that is opposite a corolla-lobe with filament broader than the others, large long anthers horizontally versatile and each bearing a brownish line along the middle, pistil single with somewhat turbinate 3-lobed and 3-celled ovary and long straight erect style that is briefly 3-toothed at apex: fruit hard and durable, oblong to oblong-globular, slightly compressed front to back, 5-9 or 10 mm. long when dry, variable in size within rather narrow limits, smooth, with slight flesh, brown when ripe and dry, micropylar-scar a whitish mark about midway on one edge or toward the lower point but sometimes covered by epidermis: seed brown, marked with a raphe on one side something like a large grape seed, the white hard albumen plain.

Two species, as here defined, in western America south of about 36° N. and extending somewhat beyond the northern tropic. Probably the distribution of the species was modified somewhat by Indians who ate the fruits and utilized other parts of the plant. "Each grove," as stated by Parish, "was the property of a particular clan, to whom belonged the right to gather the fruit."

Observers must be cautious in interpreting the hastula in Washingtonia. The hastula (ligule) is at first in two parts,—the central durable



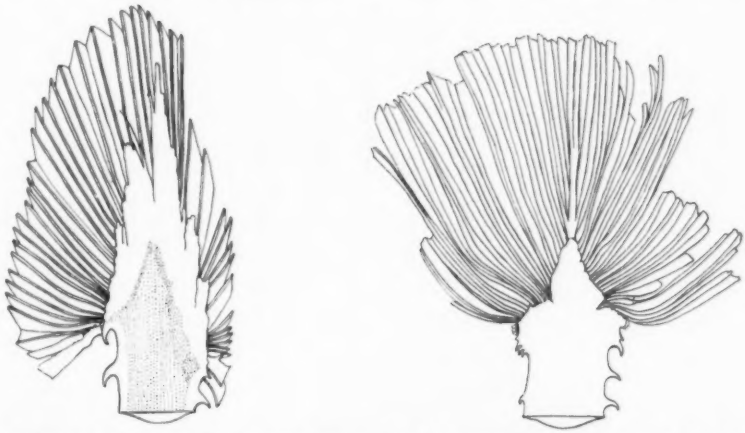
34. HASTULA of *Washingtonia filifera*. Left, the shredded filamentose margin or wing standing about the central permanent part. Right, permanent part remaining of another hastula, with only shreds of wing in place. (× ½)

plane, and the variable irregular flat wing that surrounds the plane (Figs. 34, 35). The wing may be of any shape, depending on its extent and whether it is broken and lacerated. Often it is obtuse, and on such character Parish keys out *W. sonoræ* from southern Baja California; later on, the same hastula may have lost its expansion and it then assumes its permanent outline with remains of the wing still discernable on close examination. It is not unusual to find different forms on the same tree, and yet the true hastula may be at the same time a fairly dependable structure.

Pictures of fresh flowers of the Washingtonias appear never to have been published, nor indeed of the fruits in close detailed view. Drawings made from dried pressed flowers do not express all the facts. At the period of full bloom the petals are attractively reflexed and applied close to the tube, and the long versatile transverse anthers are conspicuously exserted. Petals fall while the cluster looks to be still in flower. The facts are shown in Fig. 31.

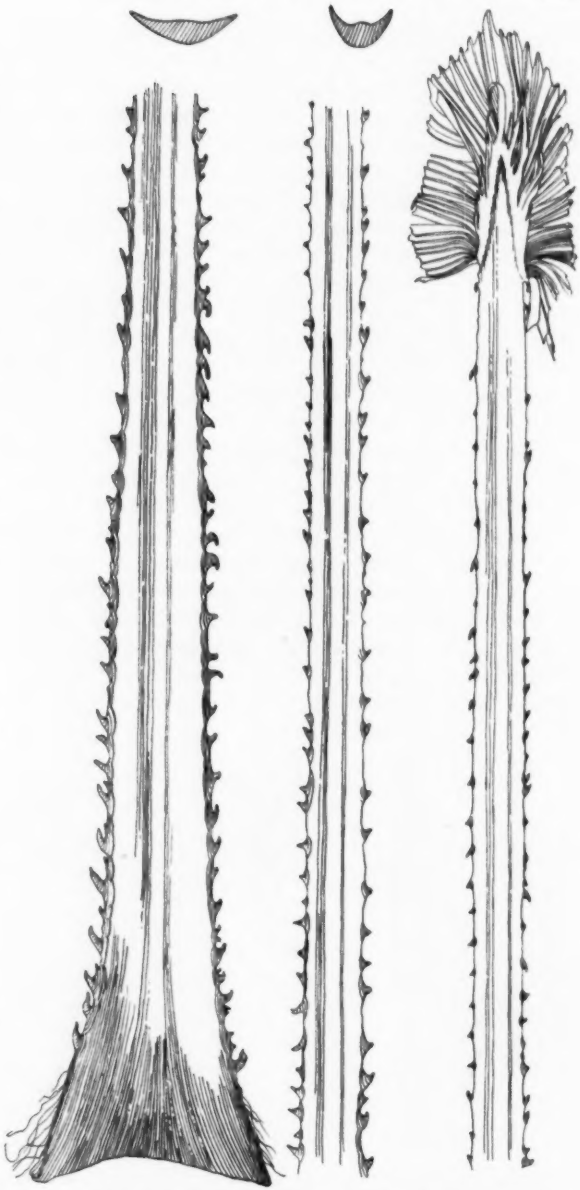
The organography of the entire spadix should be under observation. The primary spathe or sheath (Fig. 36) is seldom noticed. A unit or single cluster in fruit is seen in Fig. 33 and in flower in Fig. 40.

There appears to be confusion as respects the sexuality of the flowers. Thus Marcus E. Jones writes (Contributions to Western Botany no. 15, page 46): "So far as I can find no one seems to know if either Washingtonia or Erythea has perfect or monœcious or deciduous [diœcious?] flowers. I find that all the forms of *W. filifera* described below are either monœcious or diœcious or perfect. Whether the flowers are polygamous I do not know." Although this statement was published in 1929, S. B. Parish had

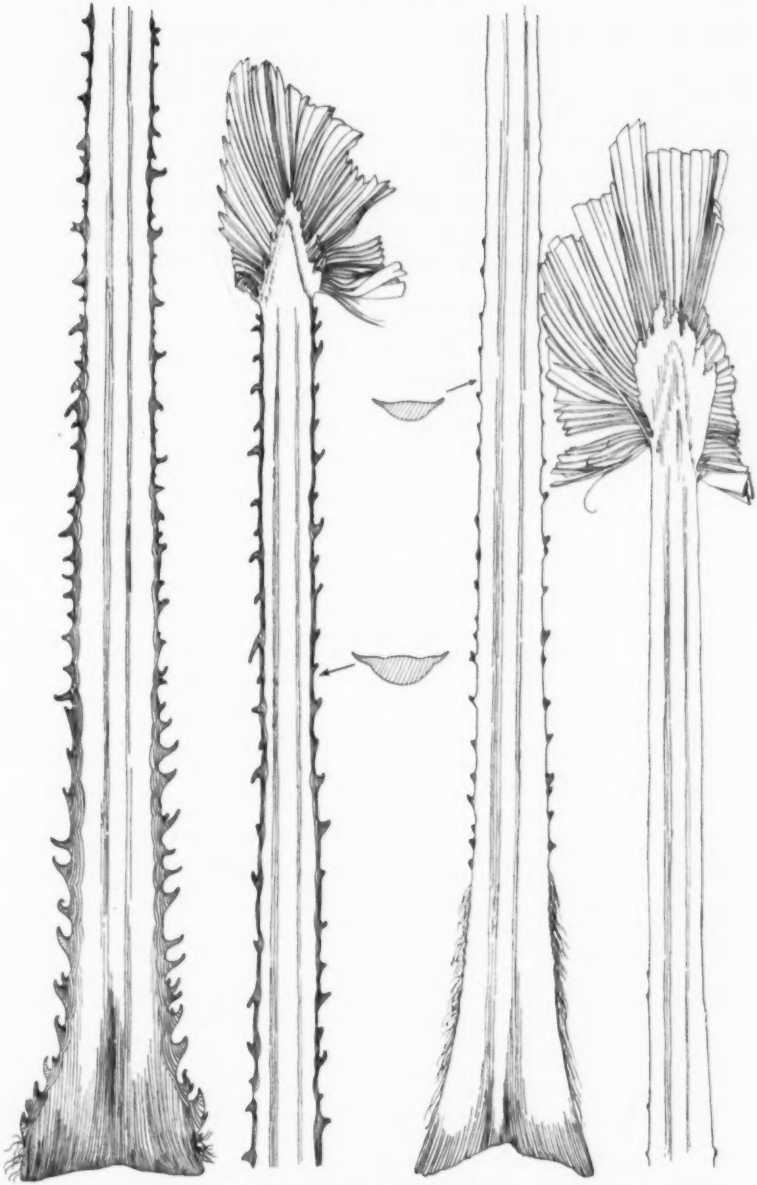


35. SHORT HASTULA of *Washingtonia robusta*. Left, the extended lacerate margin or wing in place, the permanent body of hastula indicated in center. Right, hastula after wing has perished. (× 1/9). The hastulas of Washingtonia vary greatly even in the same species

36. MAIN OR PRIMARY SPATHE of *Washingtonia robusta*. Peduncle at the base. (× 1/6)



37. ENTIRE PETIOLE of *Washingtonia filifera*, showing the relatively small spines in the middle and upper part; also the hastula with remnants of wing remaining. (× 1/9)



38. ENTIRE PETIOLES of *Washingtonia robusta*. At left, from young tree, showing large spines; at right, from tall old tree with spines absent on upper part. Also, hastulas, at left denuded, at right with obtuse wing still intact. (× 1/9)

described and illustrated the flowers of Washingtonia in a special article in 1908 (Botanical Gazette, 144-147) with illustrations made from dry herbarium specimens. Parish mentions and illustrates nothing but hermaphrodite flowers, nor have I seen other states in many examinations in nature. In Erythea, also, the flowers are uniformly hermaphrodite in all species as far as my examinations go.

Unfortunately, I have not been able to verify the floral differences between species of Washingtonia as described by Beccari in his Webbia paper of 1907 and as depicted by Parish from flowers furnished by Beccari.

The gray-green Washingtonia, with green not heavily spiny petioles unless toward the lower end: stout palm at fruitful age with heavy barrel-like trunk usually not suddenly expanded at base, the old denuded ones marked with perpendicular lines and chinks as well as faint circular lines: head or crown loose and open due to long petioles and the upper leaves upright and the lower old dead ones hanging prone and disclosing face of the flat petioles: hastula long and pointed, usually 10 cm. or more (when the split lacerate wing has perished): blade lacking a definite tawny patch on under surface about the hastula, very filiferous and often with copious filamentose tuft at end of segments, most of the long limp attenuate segments downward bent or hanging: shag of dead leaves broad dense and even and commonly tapering toward base when the lower part of trunk is bare, and accompanied by hanging dead more or less covered or reflexed flower-branches: old petiole bases (after leaves are cut) making a compact trunk cover not in regular pattern. . . . . 1. *W. filifera*

The brilliant-leaved Washingtonia, with red-brown leaf-sheath and very spiny brown petioles until tree attains age and much elevation: slender palm at fruitful age, the trunk flaring-expanded at base and the old denuded ones bearing many strong circular rings or ridges: head or crown close and usually compact, the leaves (except the terminals) mostly horizontal and petiole faces not conspicuous: hastula usually not exceeding 6-8 cm. long and short-triangular (after the lacerate wing is gone): blade carrying a tawny bright tomentose patch about size of hand on under side at the hastula (specially marked on fresh leaves), prominently filiferous only in the very young or seedling stage and mostly without prominent apical tufts, segments stiff on trees at young or middle age but variously drooping as the tree approaches bearing maturity and upper altitude: shag of dead leaves cylindrical and narrow although not even, the old flower-branches commonly standing out squarely through it: old petiole bases (after leaves are cut) making an open criss-cross something like palmetto, as in Figs. 42 ,43, 44. (The bright green of leaves may be obscured by smoke and dust in cities). . . . . 2. *W. robusta*, page 73

1. **Washingtonia filifera,** Wendl. ex Wats. in Bot. Calif. ii, 211 (1880). NORTHERN OR CALIFORNIA WASHINGTONIA.

Pritchardia filifera, Linden ex André, in Ill. Hort. xxi, 28 (1874); Ill. Hort. xxiv, 32 and 105 fig. (1877); A. W. Eichler, Zur Entwickelungsgeschichte der Palmenblätter in Phys. Abh. Akad. Berlin, 1885, i, p. 5, t. 1.

Pritchardia filamentosa, Fenzi, in Bull. R. Soc. Toscana Ort. i, 116 (1876); Williams, in Gard. Chron. n. s. vi, 80 (July 1876); Drude, in Bot. Zeit. xxxiv, 806 (Dec. 1876); Kuntze, Rev. Gen. ii, 737 (1891).

Brahea and *Pritchardia filifera*, Wendl. in Bot. Zeit. xxxvii, 67 (1879).

Brahea filamentosa, Kuntze, Rev. Gen. ii, 737 (1891).

Washingtonia filamentosa, Kuntze, Rev. Gen. iii, 323 (1893).

Neowashingtonia filamentosa, Sudw. in Bull. 14, Div. For., U. S. Dept. Agr. 105 (1897).

Washingtonia filifera var. *microsperma*, Becc. in Webbia, ii, 191 (1907).

Washingtonia filifera var. *robusta*, Parish, in Bot. Gaz. xliv, 420 (1907), not *W. robusta*, Wendl.

Neowashingtonia filifera, Sudw. Forest Trees Pacif. Slope, 199 (1908).

Washingtonia filifera var. *typica*, M. E. Jones, in Contrib. W. Bot. xv, 53 (1929).

Sturdy tree with thick trunk to 15 m. and perhaps more high (reported much taller) and bole to 1 m. in diameter, presenting an open top through which one can usually look of gray-green or leaden-green foliage (not glaucous although sometimes so called), general direction of the upper leaves upward and the lower ones becoming declined and hanging (if not removed) and disclosing prominent long green petioles that are brown or reddish only at base if at all, the crown therefore often appearing as if of an upper and a lower part: shag or petticoat dense and durable, in natural places and away from cities of a bright or a light straw-color, uniform in width to the base unless the lower part of it is cut or burned or worn away in which case it tends to be narrower at the bottom, the old spadices hanging in it or along it for many years and becoming bleached: bole of old or mature trees barrel-like in aspect, perhaps slightly expanded at base when undisturbed and sometimes presenting a contraction at the ground, the gray surface marked with characteristic up-and-down little chinks and ridges which are more prominent than the faint circular bands: petiole to 2 m. and more long, 10-15 cm. broad at base before it passes into sheath, flatly plano-convex in cross-section, bearing well separated or remote single or double curved or somewhat hooked spines to 1 cm. long for the first 4 or 5 dm. and then the margin with progressively smaller teeth until they nearly or quite disappear at the apex: hastula various but ordinarily the body of it long and tapering to apex 6-16 cm. and the thin margins commonly deeply

split: blades very large, to 2 m. and more across and likely to be longer than broad as it hangs, segments 50 and upward and usually extending more than one-half distance to the hastula so that the palman is relatively small, central segments to 4 and 5 cm. broad, apex very long and deeply divided and frayed into filaments and filaments abundant also in sinuses and on the margins, longitudinal veins numerous and regular, the segments or at least the lateral ones variously over-curved and hanging but those on recent erect central leaves mostly standing upright: spadices commonly 3-4 m. long at maturity, at first shooting upright and then becoming horizontal and drooping and extending beyond the foliage and in fruit hanging and eventually becoming involved in the accumulating shag where their framework may long remain, more or less forked but not prominently compound, the "hands" or flower-bearing elements emerging from a sheathing spathelet that has an expanded finely striate end more or less ½ m. long and 3-5 cm. broad and that may bear a thinning scurfy pubescence on one or both surfaces; "hand" or ultimate flowering element 30-40 cm. long, once- and twice-branched, the very slender glabrous rachillæ to 20 cm. long and bearing very many whitish-stramineous nearly sessile flowers each above a small scarious bract: flowers in anthesis 8 or 9 mm. long from base of calyx to top of horizontal anthers and about 5 mm. broad across the reflexed petals; calyx-tube about 5 mm. long and only obscurely lobed at top and over which the striate lanceolate petals are reflexed to its base, the stamens prominent beyond the throat and quite obscuring the very slightly lobed

39. LEAF FROM BEARING TREE of *Washingtonia robusta* in the wild. Sonora. Note the hastula, with wing not yet broken away.

40. FLOWERING SPRAY of *Washingtonia robusta*. Mexico. About natural size.

style which is nearly or about their length: fruit short-oblong or ellipsoid or ovoid and holding at base remains of the non-accrescent calyx, black or brown, glabrous, 7-10 mm. long at dry maturity and 5-7 mm. broad, the exocarp mostly lightly wrinkled lengthwise when dry and variable in thickness, style usually present on apex; seed single, of the general shape of fruit, 5-7 mm. long, attached at one side of base with raphe-scar extending as a line upward.

Southeastern California in the Colorado desert country, in southern San Bernardino, Riverside, San Diego and Imperial counties, along the streams in canyons, and about springs and seepages in more open areas (for particular localities consult W. L. Jepson in Flora of California, part vi, 243, 1922); in a deep obscure canyon in the Kofa mountains, Yuma County, western Arizona; in Cantu and Cantillas (Tajo) canyons on the eastern side of the Sierra de Juarez, Baja California, perhaps twenty-five miles south of the international boundary if it were possible to go by straight line but which required a southward journey of about fifty miles from Calexico on the border. These canyons I have visited, and have had the benefit of subsequent expeditions in that region by Randall Henderson, by the San Diego Museum of Natural History, and by George Lindsay. We shall visit these canyons again in our study of Erythea. (Note may be made in passing that the names of these canyons are not definite, and that changes may be required). Other native localities may exist, but I have not seen specimens. It is an interior species wherever I have seen it native.

The first botanical description of *Washingtonia filifera* was in 1880 by Watson in his Botany published as part of the Geological Survey of California. He cites Wendland as author of the binomial, as have others subsequently, but that author did not put these two names together in his article of 1879. Watson's plant is the native California species, and the horticultural accounts and the pictures before his time sufficiently identify the same palm.

The name *Washingtonia arizonica* is more or less in use for the palm found in western Arizona. As early as 1880 Sereno Watson in Botany of California had accredited *W. filifera* to "Western Arizona" but there are no specimens, as far as I know, for verification, and perhaps he stated the range from the original reports in Europe of an Arizona origin. History of the discovery in Arizona is given in the Morning Sun of Yuma for December 5, 1923:

"The information that led to the discovery of an indigenous palm in Arizona was secured by Peter T. Robertson of Yuma from William Hoy of Quartzite. Mr. Robertson was convinced that genuine palms, not merely yuccas, had been seen in the vicinity of the North Star mine, and published this information in the Sun of August 1, 1923. Local representatives of the Department of Agriculture, Harry A. Gunning and H. G. McKeever were interested to verify this report, and a visit to the North Star district was

made in August, but was not successful in locating any palms. More definite information was secured later from A. J. Eddy, which led to another attempt being made in October, when Messrs Gunning and McKeever were accompanied by R. D. Martin of Sacaton. True palms were found October 24, growing in narrow steep canyons of a mountain between Quartzite and Castle Dome. Recently the palm locality has been visited again by Messrs Gunning and McKeever, accompanying Mr. O. F. Cook, who has made a special study of the classification of palms. The study of palms is considered a difficult branch of botanical science."

In this newspaper account it is stated that "Mr. Cook intends to describe it as a new species to be called Washingtonia Arizonica," and certain differences are stated. Under the Rules this does not constitute botanical publication. Marcus E. Jones in his Contributions no. 15 (1929) mentions the binomial in his running account of Washingtonias and Erytheas, but this can hardly be regarded as publication. He says it is "intermediate between typical filifera and the var. robusta, and has no character whatever to separate it from either specifically." I saw this palm in cultivation in the United States Test Gardens at Torrey Pines, southern California in 1927, and I visited the Arizona canyon in the fantastic Kofa mountains in 1934 and obtained specimens and photographs. I regard the tree as *W. filifera*.

This Arizona canyon has been explored recently for the palms and Dr. Charles T. Vorhies of the Arizona Experiment Station writes me that in the main part of it and in a still narrower extension there are sixty-five trees. Small seedlings appear to have perished, apparently having been torn out by torrents of water. The big trees, however, are fruitful.

2. **Washingtonia robusta,** Wendl. in Garten-Zeit. (Berlin), ii, 198 (1883). SOUTHERN OR MEXICAN WASHINGTONIA.

Washingtonia sonoræ, Wats. in Proc. Amer. Acad. Arts & Sci. xxiv, 79 (1889), xxv, 136 (1890).

Neowashingtonia robusta, Heller, in Cat. N. Amer. Pl. 3 (1898).

Neowashingtonia sonoræ, Rose, in Contrib. U. S. Nat. Herb. v, 255 (1899).

Washingtonia robusta var. *gracilis*, Parish apud Becc. Webbia, ii, 197 (1907).

Washingtonia gracilis, Parish, in Bot. Gaz. lxiv, 420 (1907).

Washingtonia filifera var. *sonoræ*, M. E. Jones, in Contrib. W. Bot. xv, 48 (1929).

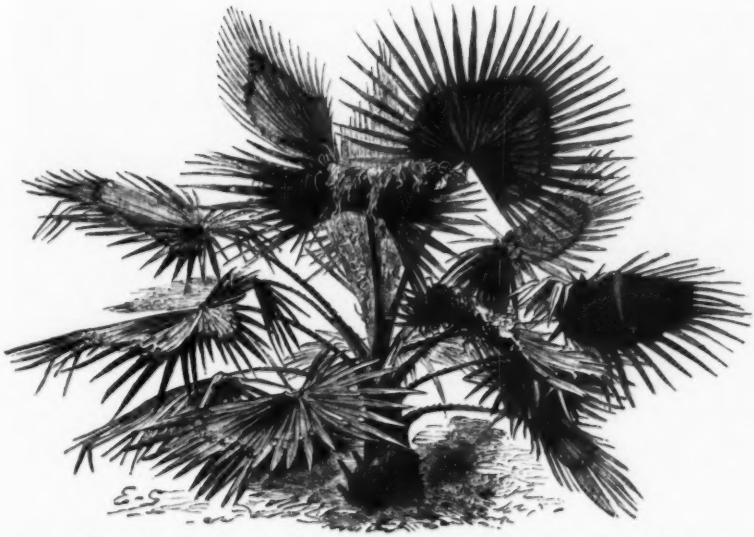
Slenderer palm than *W. filifera*, becoming taller, to 22 m. and probably more, leaves bright shining green (unless in towns), head usually narrower on tall trees and sometimes not much broader than the shag with the leaves standing more horizontally and the red-brown petioles very spiny on young trees: shag or petticoat of a more columnar aspect when re-

maining on tall trees, more or less uneven or ragged and the old spadices standing divaricately out through it, sometimes falling away in areas on the bole as toward the top with the lower part still remaining and making a patchy or unkempt-looking subject: bole of old trees less in diameter than that of *W. filifera* unless at the widening base next the ground, the brownish surface marked with distinct rings: petiole mostly shorter than in the other species, commonly reddish-brown (particularly on the vitreous glossy margins) throughout its length except perhaps in full-grown trees, the basal expansion or sheath conspicuously brown, spines on leaves of young trees large and prominent throughout its length but becoming few and small or even almost disappearing on mature trees: hastula smaller than in the other species, 3-7 or 8 cm. long, triangular-pointed or sometimes obtusely thin-edged because of the wing: blades less large and more circular in outline, the segments narrower, abundantly filiferous in the very young or seedling stage but progressively less filamentose until nearly nude in old trees, hang of the segments exceedingly various from stiff and horizontal on young plants to gracefully tip-hanging on old ones and different trees showing peculiarities in this respect; under side of blade about the hastula bearing a tawny-tomentose pad or patch; spadices commonly but not always shorter than in *W. filifera*, standing out more squarely from the head or crown and in very tall trees extending far beyond the foliage: flowers and fruits not constantly or essentially different from those of *W. filifera* except that fruits may not become as large as the largest of the other species.

In canyons and along water-courses and other moist places in Sonora and Baja California, northwestern Mexico, in proximity to the sea where I have observed it as a native plant.

The only diagnosis of this species with a definite native locality is Watson's account of *W. sonoræ* in 1889, "in secluded cañons in the mountains about Guaymas," Mexico, Dr. E. Palmer 311, collected in 1887. The specimens comprised fruits on an inflorescence, which have been examined in the Gray Herbarium, but the leaf is missing. In 1890 Watson completed the account, including descriptions of flowers, from materials collected by Dr. Palmer at La Paz, in southern Baja California. This palm appears not to have been positively rediscovered and recorded in Sonora until 1934 when found in the narrow Nacapule canyon about ten miles northwest from Guaymas which is near the middle of the eastern coast of the Gulf of California in the state of Sonora. I made another journey there in 1936, having now been thrice in Nacapule, and in 1934 I found the tree taller and better in the deep Pirinola canyon to the northward. These collections confirmed the diagnoses and the specimens of Watson. I have been able, also, to make similar verifications at La Paz and in its region southward.

The binomial *Washingtonia gracilis* was established by Parish to designate cultivated trees in southern California distinguished by the tall slender trunk, smaller and less deeply divided shorter-stalked non-filamentose leaves, the petioles with only short spines. The young tree was not



41. THE ORIGINAL *Washingtonia robusta*. André in Revue Horticole, 1885.

42. YOUNG PLANTED TREE of *Washingtonia robusta*. For comparison with Fig. 41.

described. He supposed this palm to be native in northern Lower California. He states the report of a reliable dealer to the effect that seeds were obtained "from indigenous groves in cañons, running to the sea, on the coast of Lower California, somewhere between the international boundary and Ensenada."

I have not visited such palm canyons on the way to Ensenada, but in canyons at Catavina perhaps three times as far from the border (nearly 30° N.) on the western side of the divide and within perhaps twenty-five miles of the ocean trees are to be found in native stands that apparently are *W. robusta*. (Collected by Ira L. Wiggins and George Lindsay, six years apart).

On the southern part of the peninsula of Baja (Lower) California this *gracilis* kind of palm is abundant. It is much planted at La Paz along with *Phœnix dactylifera*, and I have seen it about habitations much farther north at Loreto and elsewhere. South of La Paz I saw and collected it in native groves at San Bartolo, Santiago, Miraflores, San Jose del Cabo, Todos Santos and observed it in other places below the Tropic of Cancer. It is everywhere called *palma blanca*. Some writers have referred *palma negra* and *palma rubia* to Washingtonia, but every tree so named to me by the people was *Erythea Brandegeei*.

The reader may have admired the full-page plate of *W. robusta* (*sonoræ*) in Karsten and Schenck, Vegetationsbilder, xiii, t. 20. taken 1915 at the oasis of San Hilario in southern Baja California northward from La Paz, above 24° N.

Under particular conditions *Washingtonia robusta* may grow very tall and the trunk present a slender appearance. This is the case in many parts of Baja California, where such sky-dusters are estimated to be 80 feet high. Similar cases are also frequent in cultivation, as attested by Fig. 43, a well-known view in Los Angeles.

These tall stands recall the exalted trees of *Sabal Palmetto* one so frequently sees in Florida, bearing heads that look surprisingly small when viewed from the ground. One wonders whether they are really the same species as the usual abundant lower leafy broad-topped palmettoes, yet when one obtains good material from the tall old tops important differences are not discoverable. Nor need one be more perplexed by the variations in *Washingtonia robusta* than in *Arecastrum Romanzoffianum* (*Cocos plumosa*).

The confusion in the understanding of the Mexican Washingtonias turns about two problems,—identification of the plant meant by Wendland in his *Washingtonia robusta*, and lack of study of the trees at different ages in the wild. To these subjects we may now direct attention.

Wendland founded *W. robusta* in a short communication to a German garden paper in 1883 (Garten-Zeitung). In translation the text reads as follows:

"I should like to call the attention of palm fanciers to a first-rate novelty: Mr. L. Van Houtte of Ghent, the happy owner of this treasure, was so kind as to send me some time ago a beautiful specimen with the request for identification. I recognize in it now a second species of the genus *Washingtonia* and call it *W. robusta;* it differs from *W.* (*Pritchardia, Brahea*) *filifera* by its stronger more compact growth, by more spreading vivid green leaves whose leaf-stalks are shorter and thornier on the edges, by yellowish thorns which are curved upward and backward, by a darker blackish-purple coloring on the back of the sheath, which extends somewhat up on the leaf-stalk, by a more spherical and shorter leaf-blade.

"The species originates from the Sacramento river in California and is likely to displace the favorite *Livistona* (*Latania borbonica*) *chinensis* as a house plant; it belongs to the cold-climate palms and will become acclimatized if planted on the Mediterranean shores."

Horticulturists have objected to acceptance of the name *robusta* because *W. filifera* is supposed to be the stouter species; it is to be remembered that Wendland knew only young plants and the vigorous growth undoubtedly suggested the name: Latin *robusta* may be translated into English as *lusty* as well as *robust*. Although Wendland's account lacks exactness yet to a palm grower the compact habit, bright green spreading rather than erect leaves, short petioles with strong spines, deeply colored leaf-sheath and petiole and smaller more rounded blades separate the plant at once from the California species, *W. filifera*. There is no palm native on the shores of the Sacramento River in California; seeds had undoubtedly been sent to Europe from planted trees.

We have directer evidence on the identity of Wendland's tree in a description and picture of it published two years later by André in Revue Horticole from a consignment of trees with which Wendland was associated; the picture is reproduced in Fig. 41. This illustration shows that *W. filifera* was not meant, even though it leaves something to be desired. This article by André in 1885 gives a good account of experiences with Washingtonias in Europe up to that time.

There is no indication in Parish's full account of the Washingtonias in Botanical Gazette in 1907 that he had consulted the André picture or had seen the pictures of Fenzi and Linden of young *W. filifera*. He was puzzled by the variation of the native palms at Palm Springs, California, particularly in character of petioles, and supposed that Wendland's *robusta* was only a form or variety of it and he made the name *Washingtonia filifera* var. *robusta*. This left the tall more slender green-leaved palm introduced into California without a name and he described it as *Washingtonia gracilis*.

The indefinite beginnings of the names in Washingtonia have led to much uncertainty, and the palms themselves are so variable that they might with propriety be called two synspecies. Nobody has yet been able to mark definite limits if the species are assumed to be four or five. My own

43. EXALTED DEVELOPMENT of *Washingtonia robusta*. Los Angeles. At right, same species from Baja California, trunks probably having been burned.

interpretation of the case is that at present we know but two species of Washingtonia, that the name *filifera* (with many synonyms) applies only to the northern or California palm and that *robusta* (also with synonyms) is the southern or Mexican palm. The species *W. robusta* has definite variations due to age, so much so that it may be said to be dimorphic. It was not until I had made many careful observations on young and old trees in native groves in widely separated stations that I became convinced of this explanation.

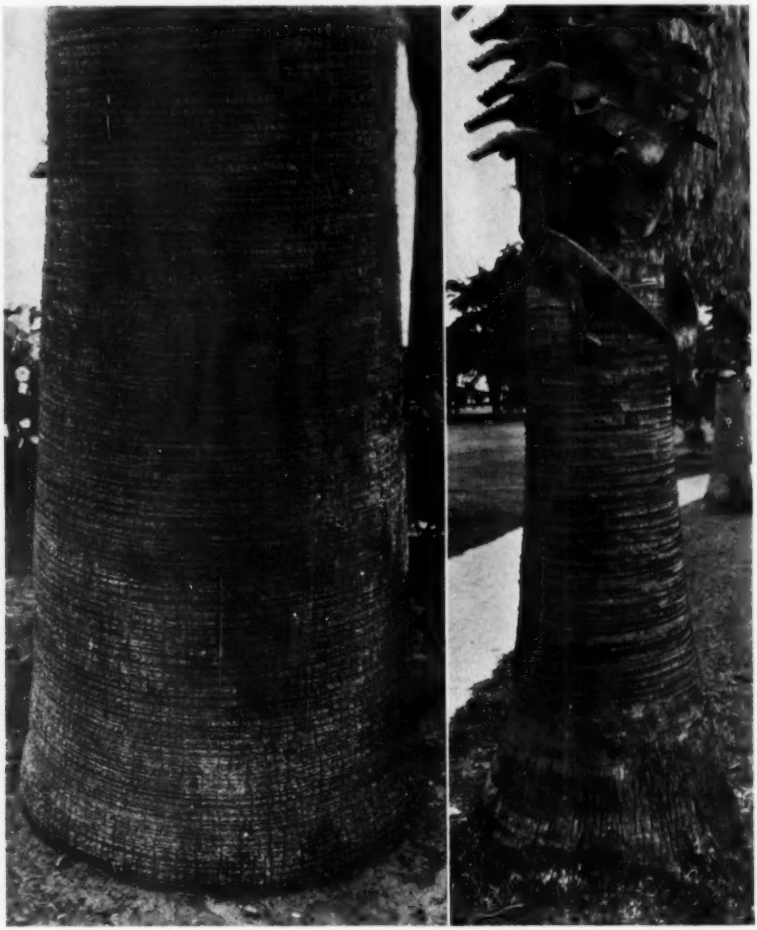
Whether these two species hybridize when brought together under cultivation is not known. It appears that no cytological studies in the genus have been published.

The southern species, *W. robusta*, is apparently more various from youth to age than is *W. filifera*. In the early seedling stage the leaves are more or less erect and very prominently filiferous; as the plant grows the leaves become strongly horizontal with very long stoutly spinose red-brown petioles, few filaments, the segments horizontal or indifferently drooping. When the trunk reaches 20 feet and more the head or crown appears relatively narrower and the shorter petioles develop few spines or even none, much of the brown color disappears, filaments are sparse or none, and the segments hang conspicuously. These changes can be observed in any grove in which trees of different ages are abundant. Even on old very tall trees with relatively short nearly or quite spineless petioles one may commonly find remains of old spiny petioles of the other kind still attached near the base of the trunk; I observed this history even on trees of Parish's *W. gracilis* that he studied and which were still standing.

Native stands of *W. robusta* often differ in growth habit from other groves; these colonies may represent seed races, for probably each group has developed in succeeding generations from one original tree. These groves are usually isolated in moist or water-course places in a dry country. I have not found what I consider to be specific characters, nor has it seemed worth while to designate botanical varieties: the differences may not be more marked than a botanist might find in other kinds of plants. Yet these differences may be the very ones that attract the attention of planters, and these people may insist they have different kinds of palms. I have been taken to see scores of planted Washingtonias that the persons declared to be separate species and to which they confidently applied the names *robusta* or *gracilis* or *sonoræ*, and I may have been unsuccessful in the effort to convince them that the examples were all a single species. The differences might not be more marked than one would see in native trees of other kinds in the region; and one could not find a stopping place where a certain kind ended and another kind began. I have seen the same range of differences in many trees in nature.

These remarks do not mean that difficulties in identification of Washing-

tonias are now all cleared up. Many dubious puzzles remain for exploration. In a few cases it may be difficult even for a practiced observer to know quickly which of the two species he has before him, probably because of variations. The species are abundantly distinct, however, and if one once learns the cardinal differences as now contrasted there should seldom be difficulty in identifying living plants.



44. TRUNKS OF THE TWO WASHINGTONIAS. Left, *W. filifera*. Right, *W. robusta*.

With these major contrasts in Washingtonia before us, we should soon be able to settle the questions of variations from norm. I shall be glad to consider these problems in the continued study of the genus. It will be futile, however, to attempt to determine these points by general uncritical observation. Good photographs (not casual snapshots) together with actual specimens well prepared will aid directly in such studies, in connection with careful notes on differences; such material I shall be glad to receive.

The greatest doubt in identification arises with herbarium material even if the student is accustomed to comparing palm specimens. Petioles are likely to be absent, and these vary anyway with age of tree. Good single mark lies in the hastula. The main part or body of the hastula (or the webs may have disappeared) is long and narrow in *W. filifera*, tending to a taper point, and is 3 to 6 inches long; in *W. robusta* it is short and triangular, mostly only 1 or 2 inches long after the web-extension is gone. Moreover, the wool-patch about the hastula on the under side is conspicuous in *robusta*, and even in old weather-worn leaves it is likely to remain as a dense woolly roll about the edges of the hastula; in *filifera* it is commonly wholly absent, although loose shreds of wool may hang on leaf-folds.

Major difficulty in the interpretation of herbarium specimens is the prevailing practice of taking leaves only from young trees, particularly when no note is made of that fact on the label. Again, one is seldom certain that flowers and fruits and leaves are from one and the same plant. Palm specimens in the herbarium may be as useful as in other plants, but commonly they are of small value in diagnosis.

This study in Washingtonia has been in process many years. In the course of that period many persons in different countries have given me signal aid and suggestions, to all of whom I express my gratitude. In particular I mention Ernest Braunton of Los Angeles who has sent me abundant complete materials with excellent photographs and notes of special trees of both species growing in his region.

The pictures in this paper (with the exception of the frontispiece and the small cut in Fig. 43) are made directly for it, the photographs by the author and the drawings under his direction. The frontispiece is now first engraved and published.

By way of review, as a final exercise, we may contrast the two species, as defined in this paper, by giving attention to Fig. 45, showing these Washingtonias planted together in southern California.

45. THE TWO SPECIES of Washingtonia. Two in front, *W. filifera* (with *Phœnix canariensis* behind them). Three slender tall ones in rear, *W. robusta*.